

Management of temporomandibular joint disorders: A surgeon's perspective

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ABSTRACT

Disorders of the Temporomandibular joint (TMJ) may clinically present with jaw pain and restricted mouth opening that may limit a patient's access to comprehensive dental care. The aim of this article is to provide a general overview of the current treatment strategies available in the management of disorders of the TMJ. Both conservative and surgical treatment options will be discussed as there is no one treatment for temporomandibular disorders (TMD) which encompasses a wide range of diagnoses. A multidisciplinary team approach to management is essential in the fundamental care of all TMD patients so that treatment can be specifically tailored to individual patient needs.

Keywords: Diagnosis, temporomandibular Joint, TMJ surgery, treatment.

Abbreviations and acronyms: TENS = transcutaneous electrical nerve stimulation; TMD = temporomandibular disorders; TMJ = temporomandibular joint.

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INTRODUCTION

Disorders of the Temporomandibular joint (TMJ) have an adverse effect on jaw function so that patients may present with limited mouth opening or difficulty chewing because of pain and locking in the TMJ¹ (Fig. 1). In the general dental practice setting, patients may complain of cramp like pain in their masticatory muscles or painful clicking in their temporomandibular joints (TMJ) which may have been exacerbated by lengthy dental procedures.^{2,3} While most patients recover with simple measures such as jaw rest and soft diet, others require professional care that may involve any combination of occlusal splint therapy, physiotherapy and medications.³ The aim of this article is to provide a general overview of the clinical features and current treatment strategies involved in dealing with disorders of the TMJ. The first part will briefly discuss non-surgical treatment strategies and the second part will be focusing on surgical treatment.

DEMOGRAPHICS

About 60–70 per cent of the general population harbour at least one sign of a temporomandibular disorder (TMD) and yet only about one in four people with signs are actually aware of, or report, any symptoms.¹ Furthermore, only about 5 per cent of those

with one or more signs of a temporomandibular disorder will actually seek treatment.² Of those who seek treatment for temporomandibular disorders, the majority are female who outnumber males by at least 4 to 1.¹ Although temporomandibular disorders may occur at any age, the most common time of presentation is in early adulthood. About 90–95% of treatment strategies begin with non-surgical treatment. Less than 10% of TMD patients may be suitable for surgical intervention^{3,4} as we will see later in this article.

TYPES OF TEMPOROMANDIBULAR DISORDERS (TABLE 1)

The three most common temporomandibular disorders are myofascial pain & dysfunction, internal derangement and osteoarthritis.³ Myofascial pain and dysfunction is by far the most prevalent.^{5,6} It is primarily a muscle disorder resulting from oral parafunctional habits such as clenching or bruxism that is sometimes related to psychogenic disorders such as headache, fibromyalgia, chronic back pain and irritable bowel syndrome with stress, anxiety and depression being the key features.^{7,8} Internal derangement is used to describe a temporomandibular disorder where there is an abnormal position of the articular disc⁹ resulting in mechanical interference (i.e., clicking) and

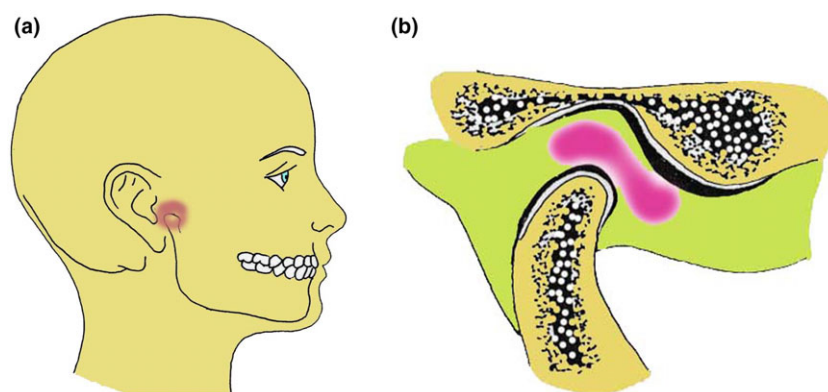


Fig. 1 The Temporomandibular joint sits just in front of the ear (left) and is composed of the mandibular condylar head (right) articulating against the glenoid fossa with an interposed fibro-cartilagenous articular disc (shown in purple) which allows smooth pain free function of the joint.

Table 1. The main temporomandibular disorders

- | | |
|---|---|
| 1 | Myofascial pain and dysfunction |
| a | Myositis |
| b | Fibromyalgia |
| c | Neuropathic pain |
| d | Chronic pain syndrome |
| 2 | TMJ functional derangement |
| a | Internal derangement - disc displacement |
| b | Hypermobility disorders – dislocation |
| c | Hypomobility disorders – ankylosis, posttraumatic |
| 3 | TMJ degenerative/inflammatory joint disease |
| a | Osteoarthritis/arthritis |
| b | Rheumatoid arthritis |
| c | Psoriatic arthritis |
| d | Juvenile arthritis |

restriction of the normal range of mandibular activity (i.e., limited mouth opening) or even hypermobility that may result in jaw dislocation.¹ Osteoarthritis is a localised degenerative disorder mainly affecting the articular cartilage of the mandibular condyle of the temporomandibular joint and is often seen in older individuals but can uncommonly present in younger patients.¹⁰

CAUSE OF TEMPOROMANDIBULAR DISORDERS

The aetiology of the most common types of temporomandibular disorders is complex and remains largely unresolved.² Psychogenic factors have been implicated but, like trauma and malocclusion, these are often considered as exacerbating factors rather than the primary cause of temporomandibular disorders.^{8,11} Hence, there is speculation that only certain patients who are vulnerable to temporomandibular disorders will develop pain and dysfunction following an exacerbating event such as acute physical or psychological trauma,^{6,7} which suggests perhaps an underlying genetic predisposition to TMD which remains an enigma.^{3,5}

CLINICAL FEATURES

There are three cardinal features of temporomandibular disorders: orofacial pain, joint noise and restricted jaw function.^{1,3} Pain is the most common presenting complaint and is by far the most difficult problem to evaluate.^{5,7} The presence of joint noises, however, is quite a common finding in asymptomatic people in the general population, and in the absence of pain, its clinical significance is of little importance.⁹ Restricted jaw function encompasses a limited range of mandibular movements in all directions. Like pain, restricted jaw function causes a great deal of anxiety for the patient who faces difficulties in everyday activities such as eating and speaking.^{8,11} Patients may describe their limited jaw opening as caused by either a generalised tight feeling (that is most likely a muscular disorder) or the sensation that the jaw suddenly “catches” or “gets stuck” which is usually related to the joint, in particular, internal disc derangement.¹

Headaches, earaches, tinnitus, neck and shoulder pains are just a few of a number of non-specific symptoms that are often reported by patients with temporomandibular disorders; however, since these are not considered to be specifically diagnostic for temporomandibular disorders, other possible causes should be sought and ruled out.^{7,12}

CLINICAL EVALUATION

Treatment of TMD relies on the correct diagnosis which, in turn, requires a history from the patient, clinical examination, and appropriate investigations that will supplement the data required to confirm the diagnosis.²

HISTORY

The chief complaint may include orofacial pain, joint noises, restricted mouth opening or a combination of

1. Please rate your pain by placing "X" on the line



VISUAL ANALOGUE SCALES

2. Please rate your ability to chew by placing "X" on the line

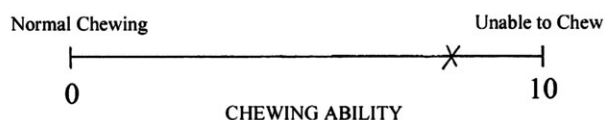


Fig. 2 Visual analogues scales for pain levels and chewing ability graded 0–10 which helps quantify the intensity of each symptom so that the progress of the patient can be objectively monitored.

these, in addition to other less specific problems such as headache and tinnitus.^{1,3} Pain should be carefully evaluated in terms of onset, nature, intensity, site, duration, aggravating and relieving factors, and especially as to how the pain relates to the other features such as joint noise and restricted mandibular movements.⁵ A visual analogue scale (Fig. 2) from 0 to 10 with 10 being the most intense pain ever experienced by the patient is a useful guide to how much of an impact the TMD has on the patient. The visual analogue scale can similarly be used for chewing ability (Fig. 2). More specifically, pain which is centred immediately in front of the tragus of the ear and projects to the ear, temple, cheek and along the mandible is highly diagnostic of a temporomandibular joint disorder.^{5,7} The pain may be accompanied by a click or grating sound in the pre-auricular region which is

evident during mandibular function such as chewing or yawning. A history of limited mouth opening which may be intermittent or progressive is also a key feature of temporomandibular joint disorders.⁹

Furthermore, underlying influences such as stress, anxiety, depression or significant life events¹¹ must also be borne out during the consultation so that a clearer picture of a psychogenic basis to the temporomandibular disorder may be constructed.^{7,8} Generally speaking, the longer the duration of the symptoms, and the greater the number of treatments, in particular 'failed treatments', the less likely the patient will favourably respond to further treatment unless a psychogenic cause can be found.^{11,13}

CLINICAL EXAMINATION

The patient should be evaluated for tenderness in those areas in head and neck accessible to palpation. Palpation is accomplished by placing the finger tips in the preauricular region, just in front of the tragus of the ear. The patient is then asked to open their mouth and the finger tip will fall into the depression left by the translating condyle. Pain specifically localised to the pre-auricular area is a good sign of actual joint pathology. Examination of the masticatory musculature may also be accomplished by digital palpation. Areas of tenderness, trigger points and pain referral patterns should be noted which may be mapped out (Fig. 3) to visualize the extend of the pain in the head and neck.⁵

Joint sounds and their location during opening, closing and lateral excursions of the mandible may be either palpated or detected with a stethoscope placed over the pre-auricular area. Clicking is a reliable sign of internal derangement while grating/crepitus is a sign of advanced degenerative joint disease such as osteoarthritis.¹

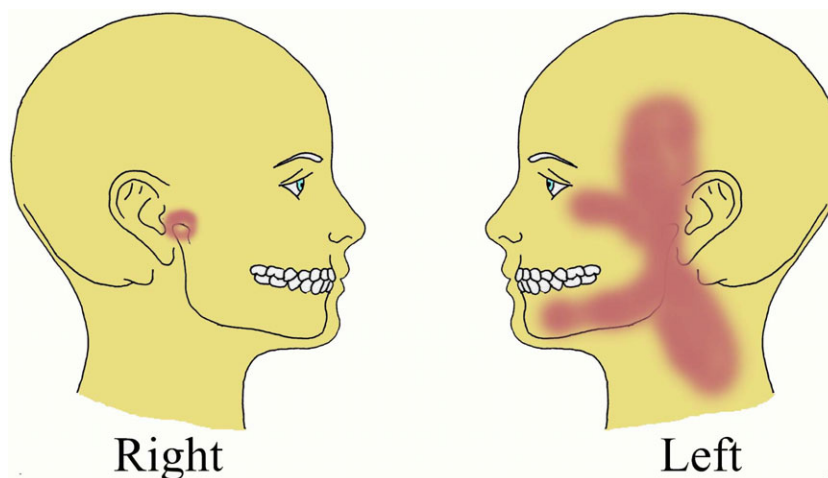


Fig 3 Facial mapping is useful for showing the site and extent of the pain with the diagram labelled *right* showing pain well localised to the TMJ and the diagram labelled *left* showing more diffuse distribution of pain suggesting myofascial pain.

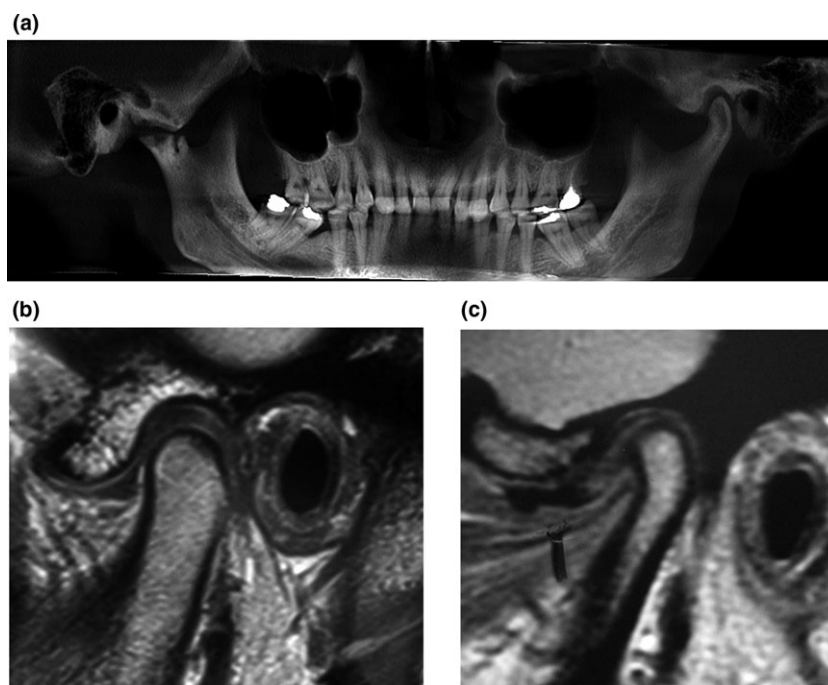


Fig. 4 (a) A digital orthopantomogram clearly showing advanced destructive and degenerative disease affecting the condyle in the left side of the image and a normal condyle on the right side of the image. (b) A pair of MRI's of the TMJ showing a normal joint on the left and a joint showing severe internal derangement on the right, (c) consisting of a severely displaced and deformed disc that is non-reducing which has resulted in the clinical presentation of chronic closed lock of the jaw.

Mandibular function may be evaluated by noting whether the line of vertical opening is straight and smooth or deviates with jerky movements, which indicate joint pathology.¹⁴ The range of painless maximal vertical opening (normal range is 40–55 mm interincisal distance) should be recorded. Anything below 40 mm inter-incisal opening is considered limited,² and anything below 30 mm requires urgent attention and referral (see below).

INVESTIGATIONS

Investigations are required to not only eliminate the possibility of other pathological processes that may mimic temporomandibular disorder symptoms¹⁵ but also to see if there is pathology specifically related to the TMJ^{1,3} (Fig. 4). Despite the limitations, plain radiographs of the temporomandibular joint, such as high level orthopantomograms and transcranial projections, are useful as baseline investigations for detection of any gross pathological, degenerative or traumatic changes in the mandibular condyle. In recent years, magnetic resonance imaging has increasingly been used in the investigation of the status of the articular disc to determine if there is internal derangement of the temporomandibular joint.^{16,17} Cone-beam CT-scans are becoming more cost effective and accessible to many Dental Practitioners and are extremely useful in showing high resolution, multiplanar images of the condylar head that clearly

shows the presence of condylar pathology such as osteoarthritis.^{3,10}

DIAGNOSIS

Myofascial pain and dysfunction generally presents with diffuse pain that is cyclic and distributed in multiple sites in the head and neck (Fig. 3), particularly the muscles of mastication.⁵ Pain is frequently worst in the morning and the patient will often report sore teeth from nocturnal clenching. There is often a history of stress and difficulty sleeping. Clinically, the patient will present with diffuse muscle tenderness and intermittent decreased range of mandibular movements with wear facets on the teeth.¹

Temporomandibular joint Internal derangement is the most common cause of TMD related clicking and locking and is basically due to a 'slipped disc' which has moved out of its normal position relative to the condylar head and fossa. Clinicians refer to this as disc displacement which may be reducing or non-reducing disc displacement. A reducing disc displacement is when the disc 'clicks back' into its normal position when the jaw opens so that a clicking sound occurs during opening and/or closing of the mandible. A non-reducing disc displacement is more serious as the disc is permanently displaced and occasionally deformed (Fig. 4a) so that the forward movement of the condyle is obstructed which, in some cases, results in permanent chronic closed lock of the mandible and

limited mouth opening. Internal joint derangement presents with continuous pain which is localised to the temporomandibular joint and is exacerbated by jaw function. Mechanical interferences in the joint due to disc displacement⁹ such as clicking and locking, will often result in restricted mandibular opening or deviation of the mandible to the affected side during opening and closing.

Crepitus or grating sounds emanating from the joint(s) during mandibular function is pathognomonic of TMJ osteoarthritis. Where the condition is painful, it is referred to as osteoarthritis. Tomograms of the temporomandibular joint will often demonstrate irregular shape and flattening of the condylar head (Fig. 4). Most patients with osteoarthritis complain of fluctuating levels of joint pain and jaw locking while some remain symptom free. Where tomograms demonstrate similar condylar changes in younger patients, other arthritides such as rheumatoid, juvenile and psoriatic arthritis should be considered and further investigated by a Rheumatology specialist.¹⁰

Differential diagnosis

When examining patients with suspected temporomandibular disorders, it is essential for the clinician to bear in mind the possibility of other common disorders such as dental pain, disorders of the ears, nose and sinuses, neuralgias, headaches and diseases of the major salivary glands which may all mimic the symptoms of temporomandibular pain and dysfunction.¹⁵

TREATMENT OF TEMPOROMANDIBULAR DISORDERS (TABLE 2)

The main goals of treatment for temporomandibular disorders are to reduce or eliminate pain and/or joint noises, and to restore normal mandibular function.³ This is best achieved when other contributing factors such as stress, depression and oral parafunctional habits (ie., bruxism) are addressed and incorporated into the overall treatment strategy.^{2,11} It is essential for the clinician to establish whether the fundamental problem is physical or psychogenic, as this will dictate treatment.¹⁸ Most psychogenic disorders are found in the myofascial pain and dysfunction group of temporomandibular disorders which will necessitate the employment of psychotropic medication¹⁹ and psychotherapy which is described below.¹¹

Part 1: non-surgical treatment

The non-surgical treatment of temporomandibular disorders continues to be the most effective way of managing over 90 per cent of patients.^{1,2} There are

Table 2. TMD management strategies

-
- 1 Explanation and reassurance
 - a TMD is not life-threatening
 - b TMD is not a Cancer
 - c TMD can become a chronic condition
 - d TMD can be managed
 - 2 Education and self care
 - a Soft diet
 - b Jaw rest (especially during long dental appointments)
 - c Avoid extreme jaw movements (i.e yawning)
 - d Topical heat (e.g. wheat packs)
 - e Protect face and jaws from cold weather
 - f Avoid stress and anxiety
 - 3 Medications
 - a Antiinflammatories
 - b Anxiolytics
 - c Muscle relaxants
 - d Antidepressants
 - 4 Jaw physiotherapy
 - a Massage and stretching
 - b Dry needling
 - c TENS – transcutaneous electrical nerve stimulation
 - d Pulsed ultrasound therapy
 - 5 Occlusal appliance therapy
 - 6 Behavioural therapy
 - a Lifestyle counselling
 - b Relaxation therapy
 - c Hypnosis
 - d Biofeedback
 - 7 Psychotherapy
 - 8 Other
 - a Acupuncture
 - b Botox injections
 - c Chiropractic manipulation
 - 9 TMJ surgery
 - a Closed procedures
 - i TMJ arthrocentesis
 - j TMJ arthroscopy
 - b Open procedures
 - i TMJ arthrotomy/arthroplasty
 - ii TMJ joint replacements.
-

numerous non-surgical modalities of treatment for temporomandibular disorders (Table 2) which involve not one, but a number of different clinical specialists who come together under the umbrella of a multi-disciplinary team. Although each of the treatment modalities will be discussed separately, in clinical practice, they are best used in combination for optimal success depending on the patient's needs.^{1,18}

Explanation and reassurance

To begin with, the first step in the management of temporomandibular disorders is to explain to the patient the cause and nature of the disorder they present with, and to reassure them of the benign nature of the condition. Many patients will benefit from the reassurance that the symptoms of the temporomandibular disorder they are experiencing is not a “cancer”. A thorough evaluation should effectively rule out more sinister possible causes.¹⁵

Patient education and self-care

The next step is to formulate a self-care routine which should include the following; limitation of mandibular function, habit awareness and modification, a home exercise program and avoiding stress. Voluntary limitation of mandibular function (i.e., avoid excessive chewing and talking) is encouraged to promote rest or immobilisation of muscular and articular structures,²⁰ much the same as an athlete would rest an injured joint. Hence, the patient is advised to maintain a soft diet and avoid foods where a considerable amount of chewing is involved. Furthermore, the patient should also be discouraged from wide yawning, singing, chewing gum, and any other activities which would promote excessive mandibular function. Massage of the affected muscles with application of moist heat will help soothe aching or tired muscles by promoting muscle relaxation.²⁰ Patients should also be advised to identify the source(s) of stress, and try and change their lifestyle accordingly.⁸ Lengthy dental appointments often exacerbate the TMD so the Dentist must allow the patient to intermittently rest their jaw during their appointment. The use of a mouth prop to hold the jaw open may be useful.

Pharmacotherapy

Pharmacotherapy can be a valuable adjunctive aid to the relief of symptoms when they are prescribed as part of a comprehensive management program. There is no single drug that has been proven to be effective for all cases of temporomandibular disorders.¹ Clinicians dealing with temporomandibular disorders should be well conversant with the different families of drugs which include non-steroidal anti-inflammatory drugs, opiates, anxiolytics, muscle relaxants, tranquillisers and antidepressants.¹⁹

The analgesic effect of non-steroidal anti-inflammatory drugs is specific only in cases of temporomandibular disorders where pain is the result of an inflammatory process such as synovitis or myositis. Opiates are best prescribed for moderate to severe pain over a short period of time due to their highly addictive potential. At usual clinical doses, opiates are more effective in dampening the patient's emotional response to pain rather than eliminating the pain sensation itself.⁵ In the presence of high levels of emotional stress associated with temporomandibular disorders, tranquillising agents such as benzodiazepines, or less commonly phenothiazines, are used to help the patient cope with stress by helping reduce their perception or reaction to stress. In low doses, tricyclic antidepressants have also been shown to be beneficial in the treatment of chronic orofacial pain as

often found in long standing cases of temporomandibular disorders.¹⁹

A common combination of medications is meloxicam 7.5 mg twice a day as an anti-inflammatory and amitriptyline 10 mg at night as a means of treating nocturnal clenching/bruxism until an occlusal splint is made and fitted.

Occlusal splint therapy

The most common form of treatment provided by dentists for temporomandibular disorders is occlusal splint therapy.² This may be otherwise referred to as a bite raising appliance, occlusal appliance or bite guard (Fig. 5). The idea is to protect the teeth from abnormally high loads in clenchers and grinders and also to reduce the maximum loads on the TMJ, particularly in patients with nocturnal clenching/grinding. By distracting the occlusion, maximum contraction of the masticatory muscles is also prevented which theoretically reduces muscle pain. Although the use of occlusal splint therapy has been clinically shown to alleviate symptoms of temporomandibular disorders in over 70 per cent of patients, the physiological basis of the treatment response has never been well understood.¹ Although there are many occlusal splint designs available, the most effective splints are those that are custom made, safe, comfortable to wear and do not cause occlusal changes.²¹

Physiotherapy

The aim of physiotherapy is to restore normal mandibular function by a number of physical techniques that serve to relieve musculoskeletal pain and promote healing of tissues.²² Physiotherapists may



Fig. 5 Occlusal splints are custom made of hard acrylic and cover the whole occlusal table to prevent tooth movement and malocclusion. The photo shows a maxillary occlusal splint, but mandibular splints are also commonly used.

also use adjunctive measures such as dry needling, TENS (transcutaneous electrical nerve stimulation) and pulsed ultrasound therapy to help relieve muscle pain. Physiotherapy is especially useful in the management of myofascial pain and TMJ closed lock and is essential following TMJ surgery. Close co-operation with a physiotherapist who is well versed in the management of musculoskeletal disorders of the head and neck is essential, especially those who have a particular interest in TMJ disorders.²⁰

Behavioural therapy

Where there are persistent habits which exacerbate or maintain the temporomandibular disorder that cannot be easily modified by simple patient awareness, then a structured program of cognitive behavioural therapy may be required. Behavioural modification strategies may include counselling on lifestyle, relaxation therapy, hypnosis and biofeedback which fall in the domain of professional Psychologists.²³

Psychotherapy

Occasionally, temporomandibular disorders may be the somatic expression of an underlying psychological or psychiatric disorder such as depression or a conversion disorder. Clues to this possibility are when bizarre symptoms are reported, the patient demonstrates odd behaviour, or a patient's suffering appears to be excessive or persistent beyond what one would normally expect to see in light of the condition itself. In these cases, a psychiatric referral constitutes a mandatory part of the overall management strategy.¹³

Other therapies

Acupuncture,²⁴ Botox injections,^{25,26} Chiropractic/Osteopath jaw manipulations²² and other treatments have been tried in TMD management but have yet to be accepted into mainstream practice due to lack of evidence in the effectiveness of these modalities.²⁷

Part 2: surgical treatment

The literature has shown that about 5–10 per cent of all patients undergoing treatment for temporomandibular disorders require surgical intervention.^{1,3,4,28,29} There is a spectrum of surgical procedures currently used for the treatment of temporomandibular disorders ranging from temporomandibular joint arthrocentesis and arthroscopy to the more complex open joint surgical procedures, referred to as arthrotomy.^{28,30} Oral & Maxillofacial Surgeons with a special interest in this field will often prefer to see patients undergo a period of non-surgical

therapy prior to seeking a surgical opinion.²⁹ The benefits and limitations of each of the surgical procedures are readily determined on an individual case basis.^{3,4,28,30,31}

A failure to appreciate surgical joint pathology by the Dental Practitioner may result in a concoction of non-surgical therapies that fail to address the patient's joint disease.³ Eventually, patients may become disheartened by the lack of progress and spiral into a vicious cycle of anxiety and depression as they are led to believe that there is nothing more that can be done for them. For many of these patients, TMJ surgery may well be the answer,²⁸ but the lack of familiarity on the treating clinician's part makes them reluctant to refer the patient for surgery.³ The aim of this section is to review the role of TMJ surgery and its place in the treatment armamentarium of temporomandibular disorders.

The rationale for TMJ surgery

While surgery is often considered as an option of last resort,⁴ there are instances where surgery is the definitive and sometimes the only treatment option such as in rare cases of TMJ ankyloses and tumours.²⁸ In a fundamental sense, surgery is used to restore and repair damaged tissue or remove tissue that cannot be salvaged.³⁰ Surgery is also used to promote healing of tissues by replacing missing tissues with grafts.^{3,28,29}

A clear understanding of joint pathology and the role that surgery plays in the management of joint disease are indispensable requirements for all Dental practitioners.²⁹ The right combination of symptomatic history, clinical features and radiological signs will readily reveal whether the TMD patient is an appropriate candidate for surgery.^{28,29} It is crucial that all Dental practitioners familiarise themselves with every treatment option available, and not forget that TMJ surgery is one essential treatment modality that must never be overlooked.³

Indications for TMJ surgery (Table 3)

Specific indications for TMJ surgery include chronic severe limited mouth opening and gross mechanical interferences such as painful clicking and crepitus that fail to respond to non-surgical measures.²⁸ Clinicians must be careful to differentiate between failed TMD cases that require chronic pain management and those that would benefit from a surgical opinion.³¹ Clinical features of intolerable joint specific pain and joint dysfunction, backed up by radiologically confirmed joint pathology^{16,17} are essentially the key criteria for TMJ surgical intervention.^{3,4}

The more localised the symptoms are to the TMJ, the more likely surgery will have a favourable outcome.³ Hence, pain specifically related to the TMJ, particularly

Table 3. Indications for for TMJ surgery**Absolute indications**

- 1 Ankylosis – eg. Fibrous or osseous joint fusion
- 2 Neoplasia – eg. Osteochondroma of the condyle
- 3 Dislocation – ie. Recurrent or chronic
- 4 Developmental disorders – eg. Condylar hyperplasia

Relative indications

- 1 Internal derangement
- 2 Osteoarthritis
- 3 Trauma

A General indications

- i Disorder not responding to non-surgical therapy
- ii Where the TMJ is the source of pain and dysfunction
 - a Pain localised to the TMJ
 - b Pain on functional loading and movement of the TMJ
 - c Mechanical interference with TMJ function

B Specific indications

- i Chronic severe limited mouth opening
- ii Advanced degenerative joint disease with intolerable symptoms of pain and joint dysfunction
- iii Confirmation of severe joint disease on CT scan or MRI

when pain is elicited on direct joint palpation, loading of the joint and functional movements of the joint are essential signs of surgical disease.²⁹ Mechanical

interferences arising from within the joint that limit its full range of motion, such as painful clicking, locking and crepitus, are all good indicators of likely surgical disorders.²⁸ It must be stressed that where significant joint pathology has been identified, both clinically and radiologically (Fig. 6), non-surgical therapies only treat the symptoms.²⁹ In situations of severe joint pathology, such as degenerative joint disease causing significant pain and dysfunction, surgical intervention should be considered a viable option.^{3,28}

It is critical to point out that surgery has no role in the management of patients with chronic pain syndrome or muscular problems that do not involve the joint itself.^{3,29}

Surgical procedures to the TMJ (Table 4)

There are a myriad of TMJ surgical procedures which restore, repair or remove damaged or diseased joint tissues.^{3,28,30} Not all Oral & Maxillofacial Surgeons are trained in TMJ surgery which is a highly specialized area of surgical practice that few surgeons have

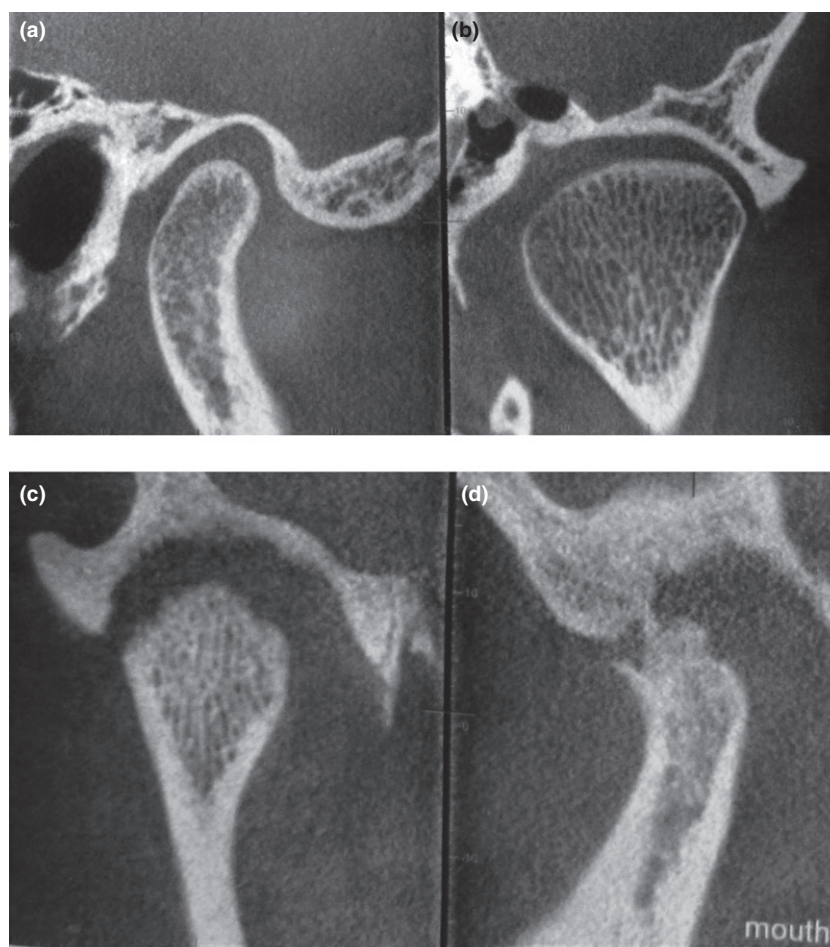


Fig. 6 (a) Cone-beam CT scans showing a normal mandibular condyle in the sagittal and (b) coronal planes while (c) and (d) show a severely degenerate mandibular condyle on the right. Surgery is a viable option for the management of TMJ advanced degenerative joint disease like the case depicted in (c) and (d).

Table 4. TMJ Surgical Classification (Dimitroulis, 2013).⁴³ A new classification based on the old Wilkes (1989).⁴⁴ Classification for TMJ Internal Derangement, but encompasses a wider range of TMJ surgical disorders with guidance as to the most appropriate surgical procedure where conservative/non-surgical measures have failed to alleviate the symptoms

CATEGORY 1	TMJ Normal Although painful, the joint itself shows normal, smooth joint function and radiology confirms no joint pathology. TMJ Surgical intervention is contra-indicated
CATEGORY 2	TMJ Minor Changes (All components Salvageable) An example is early stage TMJ internal derangement which has resulted in closed lock. TMJ arthrocentesis or TMJ arthroscopic lavage may be helpful in releasing the joint
CATEGORY 3	TMJ Moderate Changes (Mostly Salvageable) Examples include non-reducing disc displacement or recurrent TMJ dislocation where TMJ operative arthroscopy or TMJ arthroplasty/disc repositioning may be appropriate
CATEGORY 4	TMJ Severe Changes (Partly Salvageable) Example includes severely displaced and deformed discs which have resulted in chronic pain and limited mouth opening. The disc cannot be salvaged and these cases require discectomy
CATEGORY 5	TMJ Catastrophic Changes (Nothing is Salvageable) A classic example in this category is end-stage joint disease such as severe osteoarthritis. These cases are best treated with total joint replacement

adequately mastered. Therefore, it is imperative that dental practitioners look for Oral & Maxillofacial (OM) Surgeons with specialized skills in TMJ surgery when referring patients for surgery. TMJ surgery may be divided into two major groups (Table 2); closed procedures such as TMJ arthrocentesis and TMJ arthroscopy (Fig. 7), and open procedures such as TMJ arthroplasty and joint replacement surgery. A recently published TMJ Surgical classification by Dimitroulis³¹ helps categorize the myriad of TMJ surgical disorders that are amenable to TMJ surgical intervention and is summarized in Table 4.

Closed TMJ surgical procedures

Temporomandibular joint arthrocentesis and arthroscopy have proven to be the most effective way of managing 'stuck' joints by the simple process of lubricating the superior joint space and allowing mobilization of the articular disc.^{32,33} While TMJ arthrocentesis is useful for cases of acute onset closed lock³⁴ TMJ arthroscopy provides a more effective approach to the management of chronic (>3 months) or recalcitrant cases of closed lock.³²

TMJ arthrocentesis was introduced in the early 1990's as a simple and cost effective technique for

lubricating the joint and introducing various medications such as steroids and hyaluronic acid directly into the superior joint space.³⁵ It involves the use of two 19 gauge needles inserted directly into the superior joint space where one needle acts as the inlet for irrigation fluid and medicaments and the second needle provides the outlet to prevent fluid build up in the joint. TMJ arthrocentesis is widely practiced and is the treatment of choice of OM Surgeons who otherwise have limited experience in TMJ surgery.³⁶

Temporomandibular joint arthroscopy is a sophisticated version of arthrocentesis that involves the use of highly sophisticated equipment and requires a more advanced skill set that is only undertaken by OM Surgeons who have a special interest in TMJ surgery. TMJ arthroscopy is a technically challenging procedure that is practiced by highly skilled OM Surgeons who can perform incredibly complex surgical procedures ranging from surgical debridement to disc repositioning and repair, all done through miniature portholes. A camera attached to the arthroscope allows the surgeon to see and record the insides of the joint space with incredible detail. Unlike Arthrocentesis, TMJ arthroscopy provides an amazing view of the joint that reveals a whole world of pathology rarely seen by even the most experienced TMD specialists of the non-surgical realm.^{29,33}

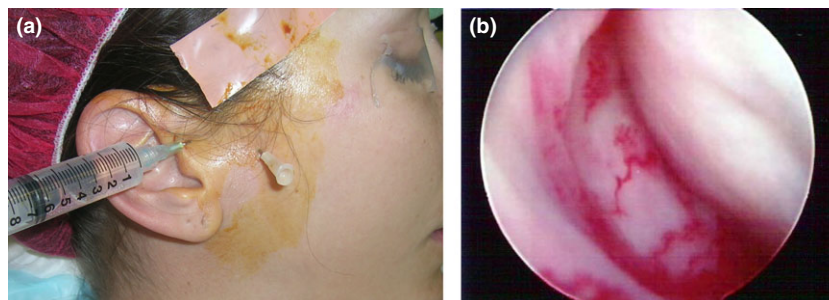


Fig. 7 (a) TMJ arthrocentesis is shown in the right photo with isotonic fluid being injected into the joint and an outflow needle to prevent build up of fluid in the joint during the irrigation. (b) The right photo shows an inflamed joint as seen during TMJ arthroscopy procedure.

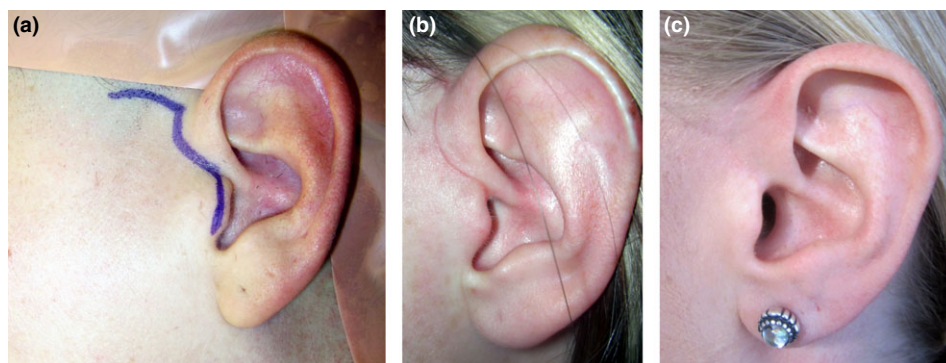


Fig. 8 Three photos showing the incision marked out for TMJ open surgery (left). The centre photo shows the operative scar 6 weeks following TMJ surgery and the right photo shows the scar 1 year following open TMJ surgery which is barely visible.

Open TMJ surgical procedures

Open TMJ surgery, often collectively referred to as arthrotomy, involves the surgical exposure of the TMJ via an incision in front of the ear (Fig. 8). Arthrotomy permits a wide range of surgical procedures ranging from disc repair and repositioning^{37,38} to discectomy, or removal of the entire disc that is beyond repair.³⁰ When the condyle is also affected by disease, such as osteoarthritis, a condylectomy is performed which can lead to gross malocclusion if a total prosthetic joint replacement is not undertaken.³⁹

Arthrotomy is used when the joint itself is damaged through trauma, degenerative, or inflammatory disease which fail to respond to other measures such as medication and occlusal splint therapy.²⁹ Repair or removal of diseased joint components is facilitated by direct surgical exposure of the TMJ through a carefully made preauricular incision that is cosmetically placed in front of the ear and avoids damage to vital structures such as the upper branches of the facial nerve.³⁰ Depending on the circumstances, the surgery may last anywhere between 1 and 2 h and tissue grafts may be required to replace joint components which cannot be salvaged. Patients normally have an

overnight stay in hospital and a recovery period of about 2 weeks before returning to work. Like orthopaedic surgery, TMJ surgery should be routinely followed up with a rehabilitation program of physiotherapy and jaw exercises.²⁰

In extreme cases, where all the TMJ components are beyond salvage, the condylar head of the mandible is resected.³⁹ When a complete condylectomy is performed to treat osteoarthritis, for example, the patient will end up with an asymmetrical lower face and severe malocclusion. Hence, in most cases where the whole TMJ must be sacrificed, a prosthetic total joint replacement is required to maintain lower facial symmetry and to preserve the existing occlusion.³⁹ The current TMJ prostheses are made of biocompatible metals and plastic which are secured to the remaining jaw and skull bones with miniature bone screws (Fig. 9). In the orthopaedic literature, it is claimed that 90% of the prosthetic hip and knee joints last about 10 years,⁴⁰ however, as the TMJ is a suspensory joint with very little compressive loads, it is likely that TMJ prosthetic joints may last a lot longer.⁴¹ Recovery from TMJ total joint replacement is usually 3–4 weeks with jaw physiotherapy and

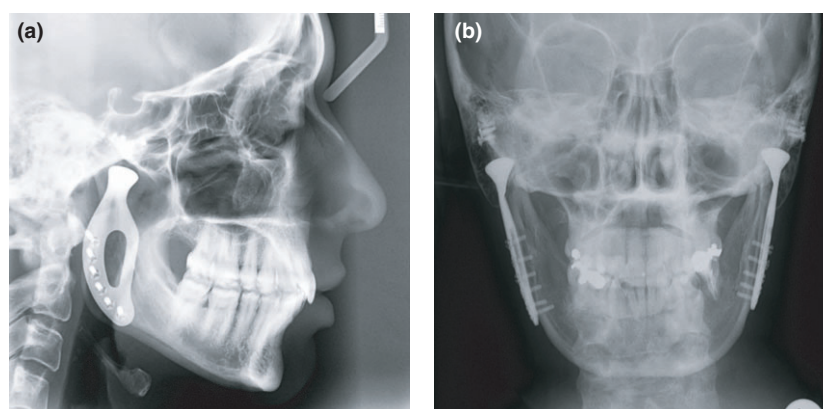


Fig. 9 (a) The left photo shows a lateral ceph view of a 3-D printed TMJ prosthesis and (b) the right photo shows a frontal view of a bilateral TMJ case with the screws which attach the prosthesis to the ramus of the mandible clearly visible. The screws in the skull base are holding the plastic fossa component of the prosthesis which is invisible on x-ray.

essential component of the rehabilitation process. Interestingly, current TMJ prostheses only allow hinge action of opening and closing with limited lateral and protrusive excursions of the mandible, especially when bilateral TMJ prostheses are placed.^{39,42}

Risks vs. benefits of TMJ surgery

The benefits of TMJ surgery can only be realised by appropriate case selection which is supported by an accurate diagnosis.^{30,31} An experienced surgeon with good patient skills will be able to identify patients who are compliant with treatment regimes, have a good understanding of their disorder, and do not harbor unrealistic expectations for treatment outcomes.²⁸ On the other hand, an inexperienced surgeon with poor patient skills will be tempted to operate on patients who have a poor understanding of their disorder, a long history of poor compliance with treatment, and unrealistic expectations. In these situations the risks of surgery would far outweigh the benefits.^{3,31}

CONCLUSION

A multidisciplinary team approach to TMD management is essential in the fundamental care of all TMD patients. Dental practitioners who work in isolation run the risk of overlooking serious issues that may adversely impact on the long term care and well-being of the patient.³ Therefore, it is important that input from all members of the specialist TMD team are carefully considered so that the various TMD treatment modalities can be specifically tailored to each and every TMD patient.¹⁸

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